

CHAPTER V

SUMMARY AND CONCLUSIONS

Skin temperature retrievals are currently made operationally using both the GOES-8 Imager and Sounder for numerous studies at the GHCC, including Imager ST morning tendencies being assimilated into the MM5 short-term forecast model. Because of the loss of the 12 μm channel from the Imager on upcoming satellites, the Sounder will have to provide the data for future operational use. This study examined the differences between the ST retrievals produced by the GOES-8 Imager and Sounder. The GOES-8 retrievals were also compared to land and sea ground truth measurements and to retrievals derived from the GOES-11 satellite.

The primary purpose of this study was to evaluate the GOES-8 Imager and Sounder ST retrievals produced using the PSW technique and to determine if there are any significant differences between the GOES-8 Imager and Sounder ST products. The major findings are as follows:

- Single pixel retrievals, with no averaging, display a significant amount of striping in both the Imager and Sounder products.
- When averaged from a 3x3 pixel box, but retained at single pixel spacing, the Sounder product displays almost no striping (less than the 3x3 Imager striping), but loses details of the natural variation of skin temperature.

- The Imager and Sounder mean skin temperatures across a domain agree within 1 K for 78% of the cases, and within 2 K for 97% of the cases studied.
- A bias exists between the Imager and Sounder products that is expected to be caused by instrumentation calibration error. A similar bias is displayed between NESDIS products.
- Over the ocean, averaging of retrievals is necessary and 3x3 Sounder retrievals were found to reduce noise sufficiently. The Sounder retrievals also displayed a warm bias over the ocean relative to the Imager.
- The 4 km resolution of the Imager gives it a considerable advantage over the Sounder that allows the Imager retrievals to be averaged while a high degree of natural spatial variation is retained.
- Comparisons to ground truth data provided inconclusive results because of the differences between the measurement techniques, but did reveal correlation coefficients between the ARM data and the GOES retrievals greater than 0.98.
- Comparisons to the ARM site IRT measurements revealed a seasonally changing bias that may be a result of the changing solar zenith angle and spatially varying land use over the satellite footprint.
- An average improvement factor of 1.4 in striping errors was found for the GOES-11 instruments, although the GOES-11 Sounder exhibited large striping errors during the early morning hours.
- The GOES-11 Sounder ST product exhibited a warm bias respect to the GOES-11 Imager product and the two GOES-8 products during the morning hours.

- The GOES-11 3x3 averaged Imager retrievals revealed no significant bias with respect to the other three instrument products and were closest to the ARM IRT data for the single day studied.
- Initial qualitative comparisons between a MODIS LST scene and a GOES-8 Imager scene revealed good agreement of both the pattern and magnitude of the temperatures.

From the findings of this work, it is recommended that 3x3 pixel averaged retrievals (at single pixel spacing) be utilized for most current applications of GOES ST data. If a higher degree of spatial variability is required, then the Imager product should be used. However, if a lack of striping and noise is required, then the 3x3 averaged Sounder product will most likely provide the most accurate results since most of the striping was removed from the 3x3 averaged Sounder product, but not from the corresponding Imager product.

Recommendations for future work include comparing the GOES ST products to the MODIS LST product to help quantify the overall accuracy of the GOES products. Incorporation of the surface emissivity values from the MODIS product will also help to improve the GOES retrievals. Additional improvement could be made by including the third split window channel into the Sounder retrievals. The GOES-12 satellite performed a science test from September - October 2001, and comparisons to this new satellite will provide insight into future retrievals. Improvements to the Imager and Sounder cloud masks will also improve the utility of the ST products, particularly when assimilated in the MM5 forecast model.